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(54) **METHOD AND APPARATUS FOR TWO-WAY MULTIMEDIA COMMUNICATIONS**

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(57) **ABSTRACT**

A communication device comprises a two-way video system for transmitting video data from a first location to a second location, and displaying at the first location video data received from the second location. The device also comprises two microphones for generating two audio signals, and a processor configured to map the two audio signals respectively to two speakers used by an operator at the second location. The processor is further configured to move a portion of the device about an axis in response to control signals received from the second location.

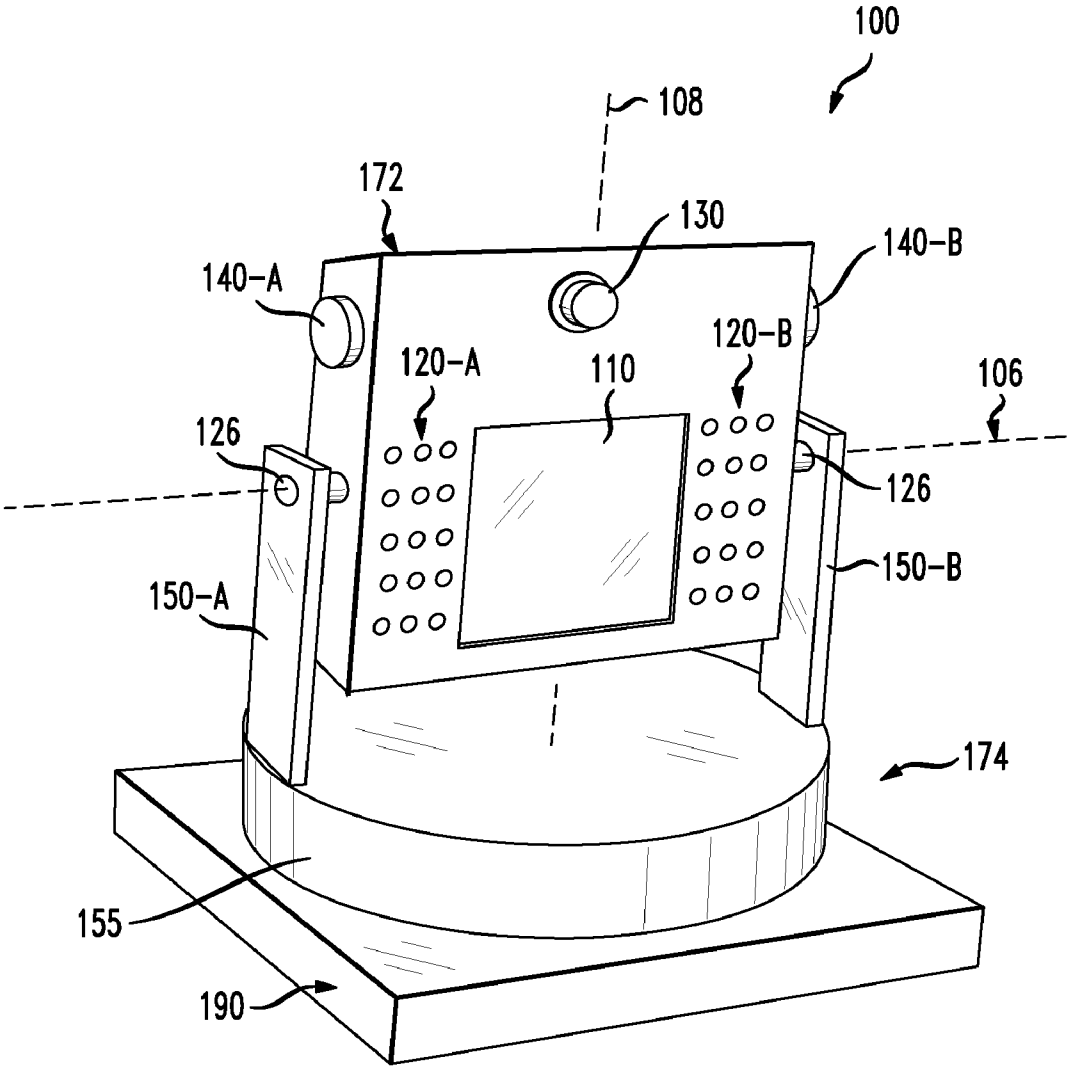
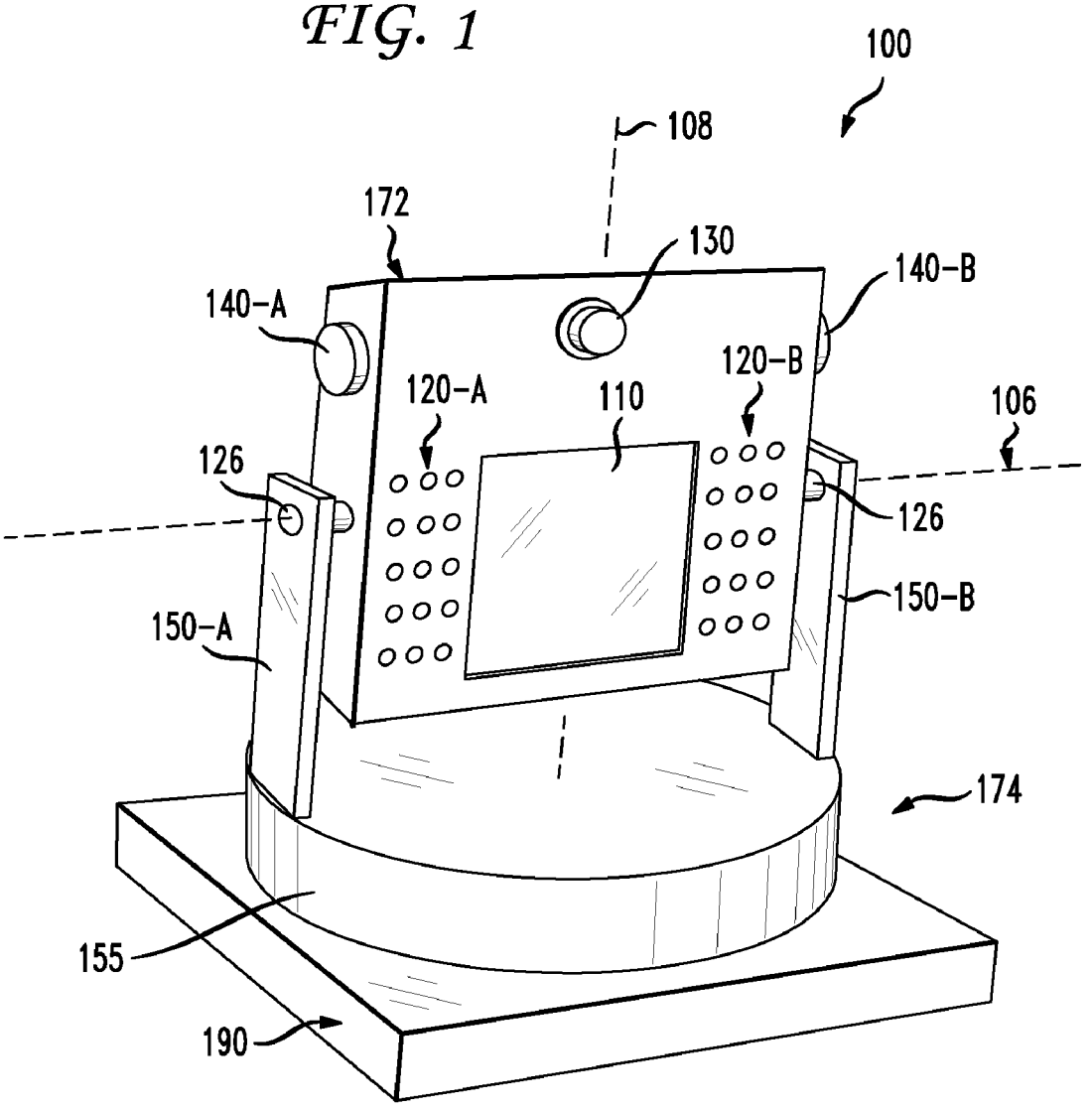


FIG. 1


100
108
172
130
140-B
140-A
120-B
120-A
110
106
126
126
150-B
150-A
174
155
190

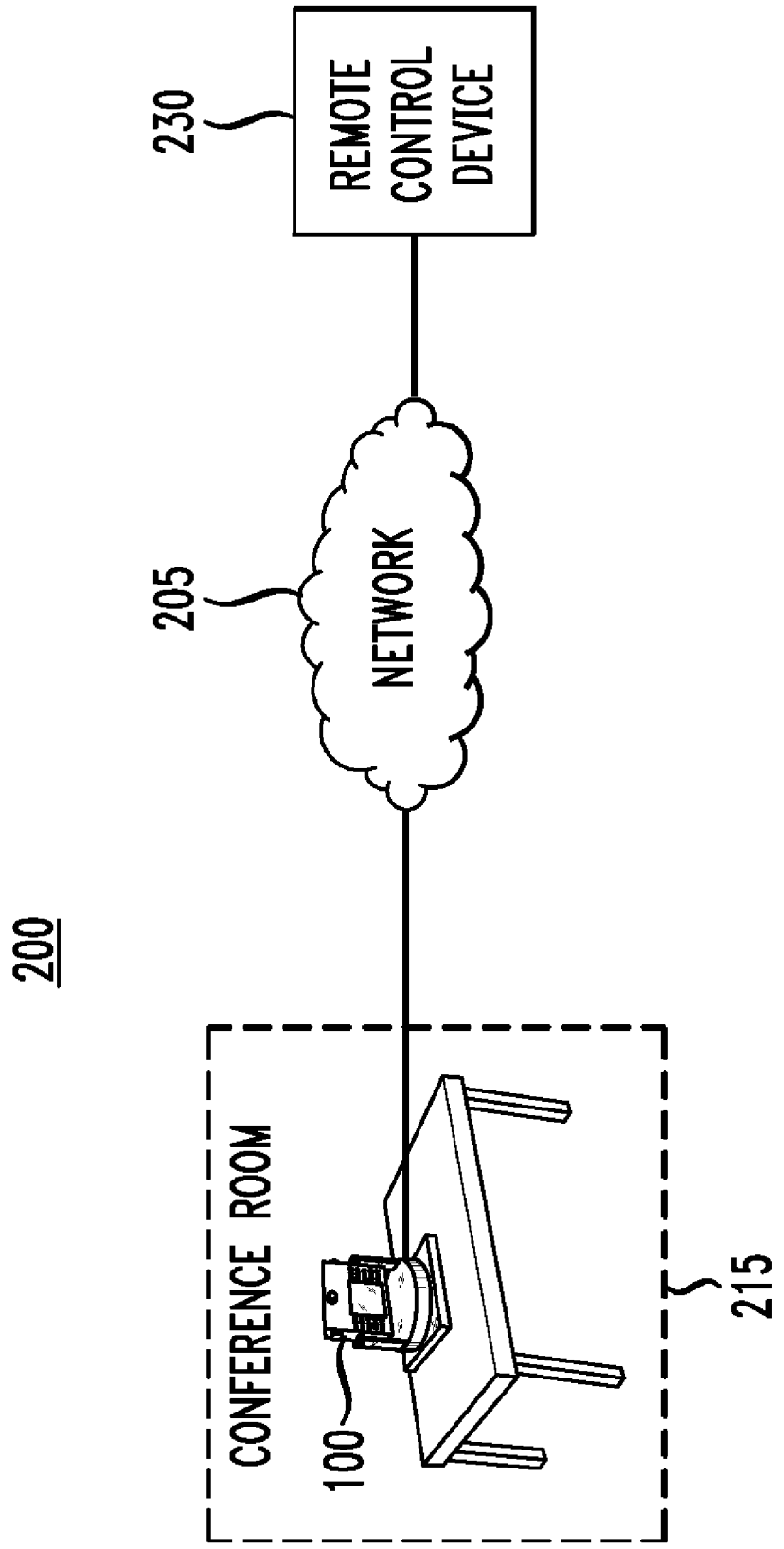

200
230
REMOTE CONTROL DEVICE
205
NETWORK
CONFERENCE ROOM
100
215

FIG. 2

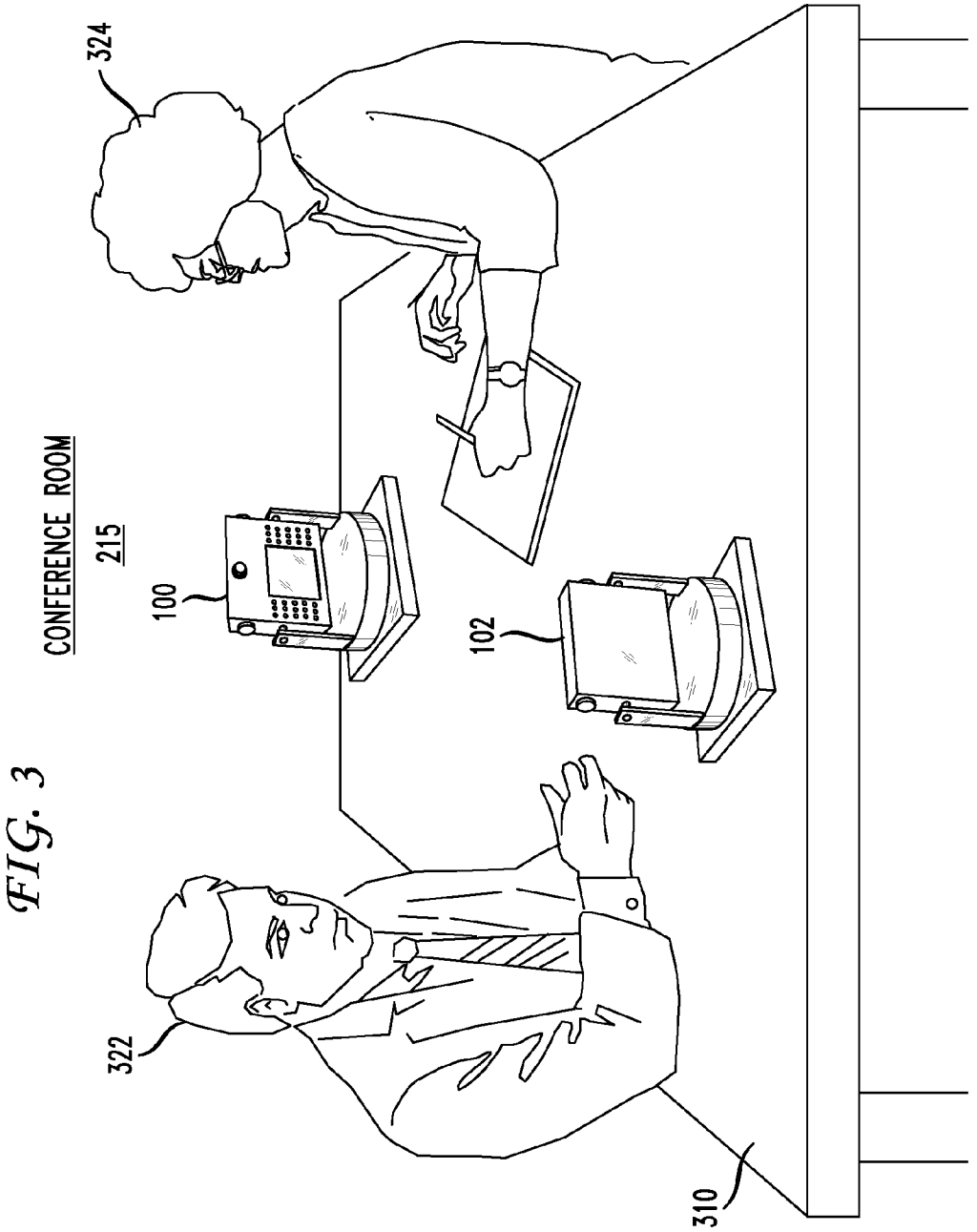


FIG. 3

FIG. 4

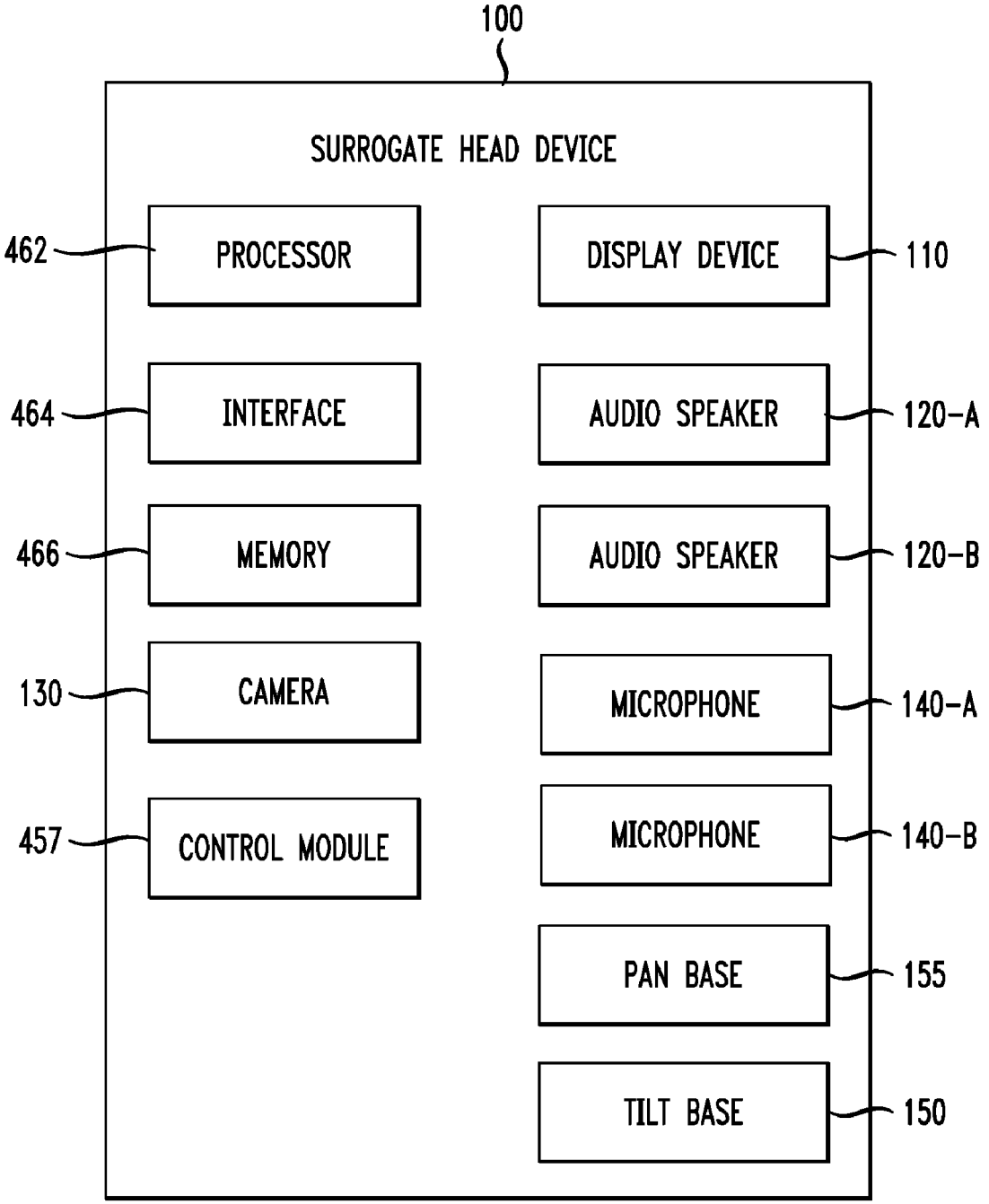

100
SURROGATE HEAD DEVICE
462
PROCESSOR
464
INTERFACE
466
MEMORY
130
CAMERA
457
CONTROL MODULE
DISPLAY DEVICE
110
AUDIO SPEAKER
120-A
AUDIO SPEAKER
120-B
MICROPHONE
140-A
MICROPHONE
140-B
PAN BASE
155
TILT BASE
150

FIG. 5

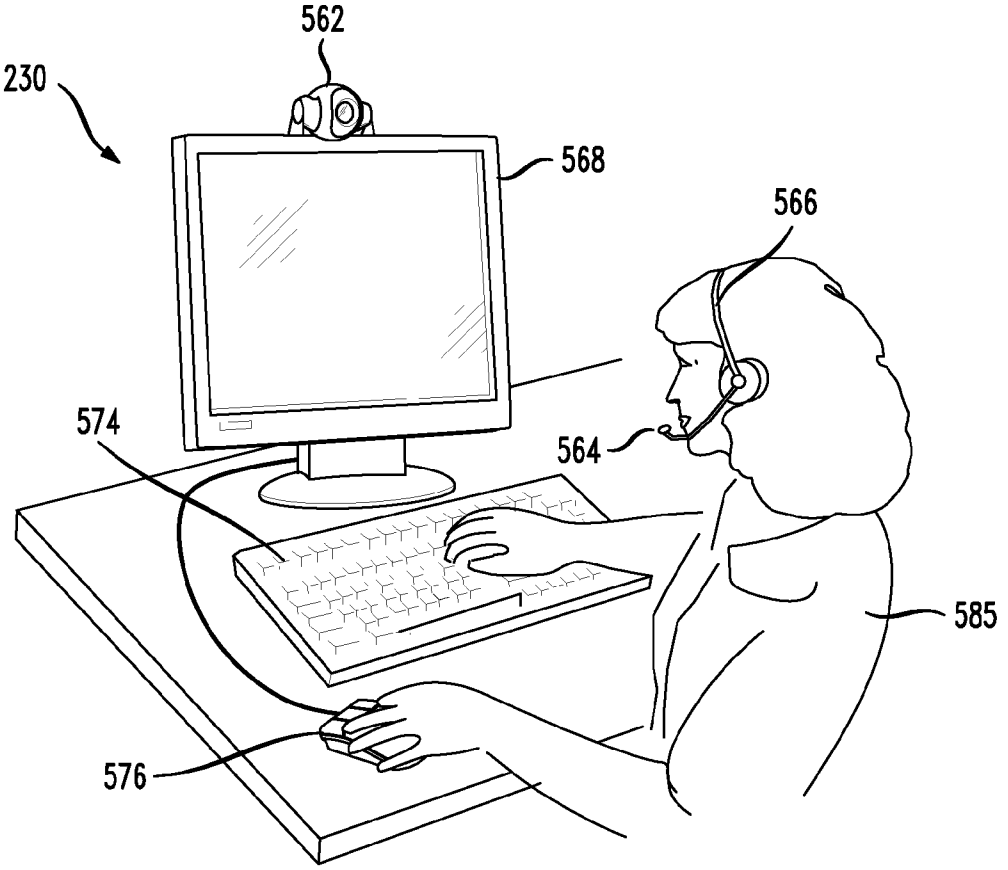


FIG. 6

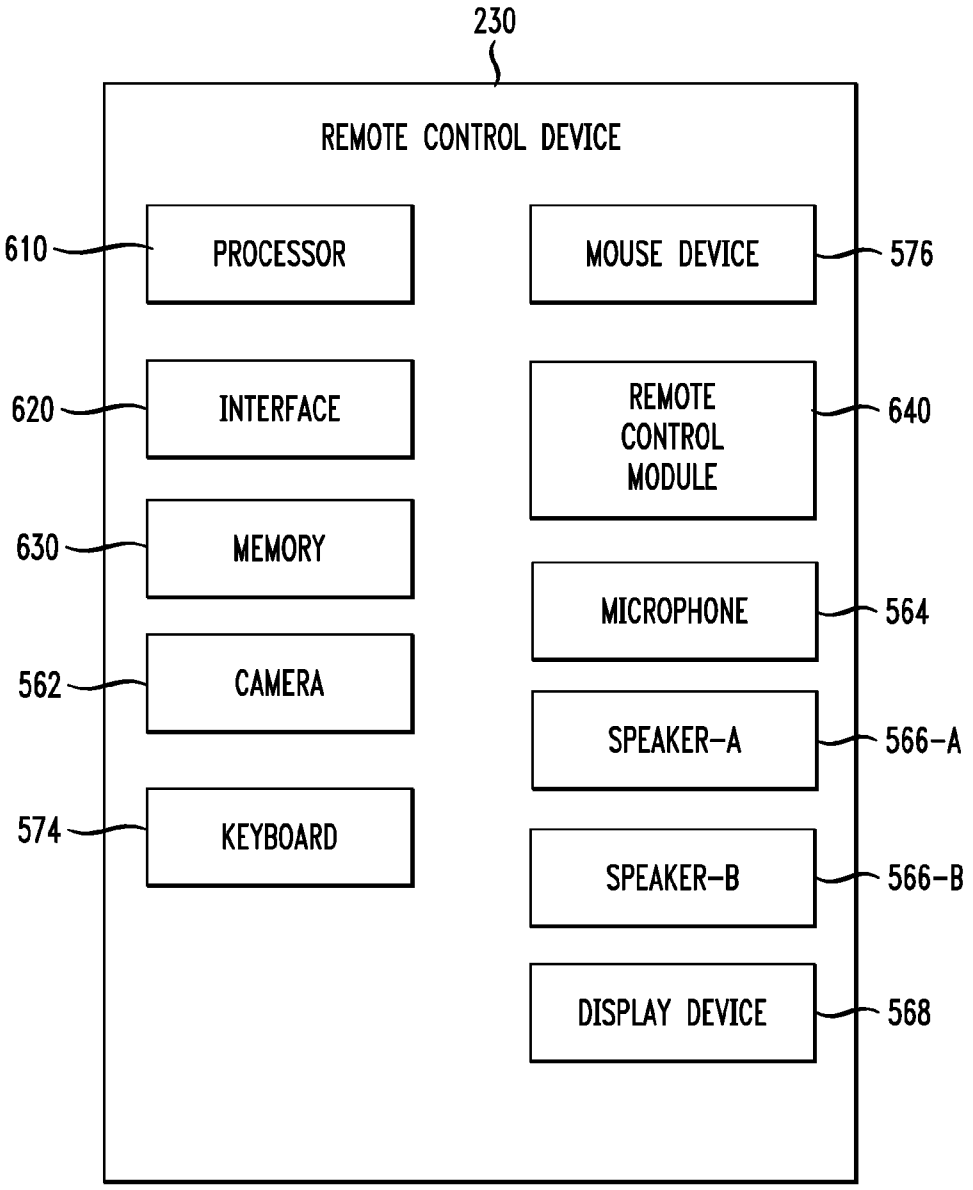
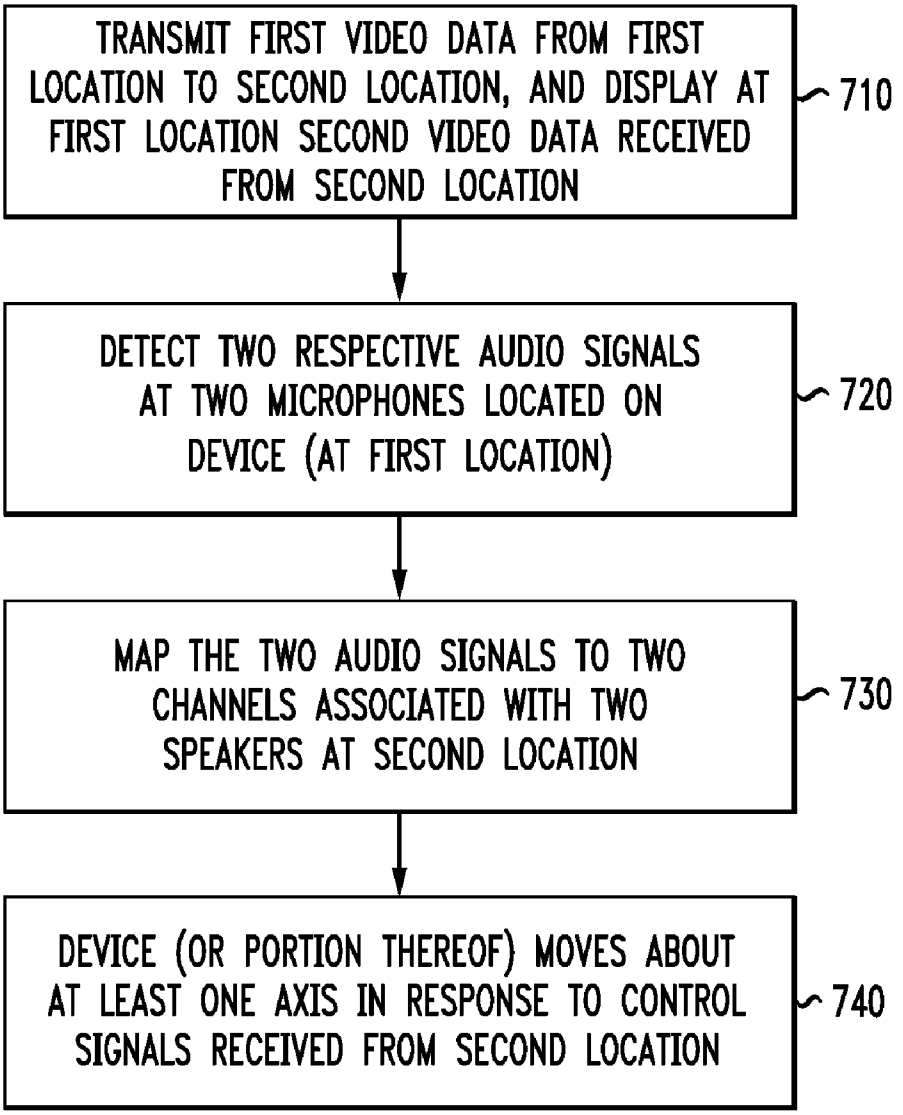

230
REMOTE CONTROL DEVICE
610
PROCESSOR
620
INTERFACE
630
MEMORY
562
CAMERA
574
KEYBOARD
576
MOUSE DEVICE
640
REMOTE CONTROL MODULE
564
MICROPHONE
566-A
SPEAKER-A
566-B
SPEAKER-B
568
DISPLAY DEVICE

FIG. 7


TRANSMIT FIRST VIDEO DATA FROM FIRST LOCATION TO SECOND LOCATION, AND DISPLAY AT FIRST LOCATION SECOND VIDEO DATA RECEIVED FROM SECOND LOCATION
710
DETECT TWO RESPECTIVE AUDIO SIGNALS AT TWO MICROPHONES LOCATED ON DEVICE (AT FIRST LOCATION)
720
MAP THE TWO AUDIO SIGNALS TO TWO CHANNELS ASSOCIATED WITH TWO SPEAKERS AT SECOND LOCATION
730
DEVICE (OR PORTION THEREOF) MOVES ABOUT AT LEAST ONE AXIS IN RESPONSE TO CONTROL SIGNALS RECEIVED FROM SECOND LOCATION
740

METHOD AND APPARATUS FOR TWO-WAY MULTIMEDIA COMMUNICATIONS

FIELD OF THE INVENTION

[0001] This specification relates generally to two-way multimedia communications, and more particularly to methods and apparatus for enabling an individual to participate in a meeting from a remote location.

BACKGROUND

[0002] Modern telecommunications technologies enable people to conduct meetings without being physically present at the same location. It has become commonplace for individuals at different locations to use telephone conferencing and/or video communications technologies to conduct business meetings, conference calls, and other forms of interaction. However, existing communication systems used to conduct such meetings typically employ only a speakerphone and perhaps one or more computer-based audio/video platforms. Existing systems do not provide to those participating in such meetings a simulated experience of being in the presence of the other participants.

SUMMARY OF THE INVENTION

[0003] In accordance with an embodiment of the invention, a communication device is provided that enables an individual to participate in a meeting from a remote location. The communication device comprises a two-way video system for transmitting video data from a first location to a second location, and displaying at the first location video data received from the second location. The device also comprises two microphones for generating two audio signals, and a processor configured to map the two audio signals respectively to two speakers used by an operator at the second location. The processor is further configured to move a portion of the device about an axis in response to control signals received from the second location.

[0004] The two-way video system may comprise a display device located on the communication device. The device further comprises a base portion configured to rotate about the axis in response to the control signals. The base portion comprises a first portion configured to rotate about a vertical axis and a second portion configured to rotate about a horizontal axis. The two microphones may be disposed in a manner to approximate a perception of sounds by a human.

[0005] The processor may be configured to map a first audio signal to a first transmission channel associated with a right side, and to map a second audio signal to a second transmission channel associated with a left side. The first and second transmission channels may be associated respectively with first and second speakers in headphones used by an operator at the second location. The control signals may be received from the second location via a network.

[0006] In another embodiment of the invention, a method for controlling a device disposed at a first location is provided. First video data is transmitted from a first location to a second location, and second video data received from the second location is displayed at the first location. Two audio signals are detected and mapped respectively to two speakers used by an operator at a second location. At least a portion of the device is moved about an axis in response to control signals received from the second location.

[0007] In another embodiment of the invention, a computer readable medium having program instructions stored thereon is provided. The instructions are capable of execution by a processor and define the steps of transmitting first video data from a first location to a second location, and displaying at the first location second video data received from the second location. The program instructions further define the steps of detecting two audio signals, and mapping the two audio signals respectively to two speakers used by an operator at a second location. The program instructions also define the steps of moving at least a portion of the device about an axis in response to control signals received from the second location.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is an illustration of a surrogate head device, in accordance with an embodiment of the invention;

[0009] FIG. **2** shows an example of a communication system, in accordance with an embodiment of the invention;

[0010] FIG. **3** shows a conference room, in accordance with an embodiment of the invention;

[0011] FIG. **4** is a block diagram of components of a surrogate head device, in accordance with the embodiment of FIG. **1**;

[0012] FIG. **5** shows a remote participant employing a remote control device, in accordance with an embodiment of the invention;

[0013] FIG. **6** is a block diagram of components of a remote control device, in accordance with an embodiment of the invention; and

[0014] FIG. **7** is a flowchart depicting a method for conducting two-way multimedia communications, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

[0015] In accordance with an embodiment of the invention, a communication device (referred to herein as a "surrogate head device") functions as a surrogate for an individual, enabling the individual to attend a meeting from a remote location. The surrogate head device is placed at a first location where a meeting is being conducted. The surrogate head device comprises a camera and microphones which capture images and sounds from the conference room; the images and sounds are transmitted to the remote location for viewing by the remote participant. The surrogate head device also comprises a display device which displays video images of the remote participant, and one or more speakers which convey voice signals received from the remote participant. Two-way communications are therefore conducted through the exchange of images and sounds between the first location and the remote participant.

[0016] The surrogate head device is supported by a support structure that allows the device to rotate to the right and to the left about a substantially vertical axis, enabling the viewing area of the camera to pan to the right or to the left, and to tilt up and down about a substantially horizontal axis, enabling the viewing area of the camera to pan up or down.

[0017] The remote participant utilizes a remote control device to control the surrogate head device. The remote control device may be linked to the surrogate head device via a network, such as the Internet. The remote control device includes a camera to capture video images of the remote participant, and one or more microphones to record his or her

voice. The video images and voice signals are transmitted to the surrogate head device. The remote control device also comprises a display screen that enables the remote participant to view images of the meeting captured by the camera on the surrogate head device, and one or more audio speakers that enable the remote participant to hear voices and other sounds detected by the microphones on the surrogate head device. The audio speakers may be two speakers in a set of headphones worn by the remote participant, for example. The remote control device also includes one or more control devices, such as a computer mouse and/or a keypad, with which the remote participant controls the movement of the surrogate head device remotely. For example, the remote participant may cause the surrogate head device to rotate to the right or left, or to tilt up or down, by rolling a computer mouse to the right or to the left, or forward or backward. The remote participant's ability to rotate the surrogate head device to the right or left, or to tilt the device up and down, enables the remote participant to achieve and maintain eye contact with a person present at the meeting.

[0018] In one embodiment, the surrogate head device comprises two microphones situated in a manner to approximate the perception of sounds by a human. The sounds detected by the two microphones are mapped to two speakers used by the remote participant, generating for the remote participant a simulation of being present at the meeting. For example, when a person seated at the meeting to the right of the surrogate head device speaks, the sounds detected by the two microphones are mapped to the remote participant's two headphone speakers and cause the remote participant to perceive a voice coming from his or her right side.

[0019] The remote participant may control the movement of the surrogate head device based on the sounds generated by the two speakers in the headphones. For example, when the remote participant perceives a voice coming from his or her right side, the remote participant may cause the surrogate head device to rotate to the right in order to view the speaker at the meeting.

[0020] FIG. **1** is an illustration of a surrogate head device **100**, in accordance with an embodiment of the invention. Surrogate head device **100** comprises a head portion **172** and a base portion **174**. Head portion **172** comprises a display device **110**, audio speakers **120**-A and **120**-B, a camera **130**, and two microphones **140**-A and **140**-B. Surrogate head device **100** may comprise more or fewer than two microphones, any number of audio speakers, more than one camera, and more than one display device.

[0021] Base portion **174** supports head portion **172** and comprises a platform **190**, a pan base **155**, and a tilt base **150**. In particular, head portion **172** is supported by tilt base **150**, which comprises two vertical portions **150**-A and **150**-B disposed on pan base **155**, and two horizontal support rods **126** attached to head portion **172**. Support rods **126** define a horizontal axis **106** between vertical portions **150**, and are configured to rotate about horizontal axis **106**, causing head portion **172** to rotate about horizontal axis **106**. Pan base **155** is disposed on platform **190** and is configured to rotate about a substantially vertical axis **108**, causing head portion **172** to rotate about vertical axis **108**. The capability of tilt base **150** and pan base **155** to rotate about two axes enables head portion **172** to rotate in order to face in a desired direction.

[0022] Display device **110** may comprise a liquid crystal display ("LCD"). In other embodiments, display device **110** may comprise another type of display device. Audio speakers **120**-A and **120**-B may comprise any type of audio device capable of reproducing voice signals and other sounds. Camera **130** may comprise any type of camera capable of capturing images and generating corresponding image data for transmission to a remote participant.

[0023] Microphones **140**-A and **140**-B may comprise any type of device capable of detecting sounds and generating corresponding audio signals for transmission to a remote participant. In one embodiment of the invention, two microphones **140**-A and **140**-B are situated on surrogate head device **100** at a distance that approximates the distance between the ears on a human's head, in order to receive audio signals in a manner substantially consistent with the reception of audio signals by a human's ears. Because microphones **140**-A and **140**-B are attached to head portion **172** of surrogate head device **100**, the remote participant may maintain an accurate sense of audio direction because the microphones are always at the same position relative to camera **130**. In other embodiments, surrogate head device **100** may be configured differently than as shown in FIG. **1**. For example, surrogate head device **100** may comprise other components, and other mechanisms may be used to move all or portions of the device.

[0024] FIG. **2** illustrates a communication system **200** that enables an individual to participate in a meeting from a remote location, in accordance with an embodiment of the invention. Communication system **200** comprises surrogate head device **100** located in a conference room **215**, a network **205**, and a remote control device **230**. Surrogate head device **100** is placed at a selected location within conference room **215**, for example on a table among individuals who are present at the conference. Surrogate head device **100** and remote control device **230** are linked via network **205**.

[0025] Network **205** may comprise one or more of a number of different types of networks, such as, for example, an intranet, a local area network (LAN), a wide area network (WAN), an internet, Fibre Channel-based storage area network (SAN) or Ethernet. Other networks may be used. Alternatively, network **205** may comprise a combination of different types of networks. In some embodiments, surrogate head device **100** may be linked to remote control device **230** via a direct connection.

[0026] Remote control device **230** is operated by an individual at a location remote from conference room **215**. Remote control device **230** conveys, to the remote participant, audio and video signals received from surrogate head device **100**, and transmits audio and video signals to surrogate head device **100**. Remote control device **230** also transmits to surrogate head device **100** control signals received from the remote participant. In this manner, the remote participant may employ remote control device **230** to control surrogate head device **100** remotely.

[0027] By selective placement within conference room **215**, surrogate head device **100** may enable the remote participant to receive audio and video signals from conference room **215** in a manner that simulates the sensation of being physically present in conference room **215**. FIG. **3** shows conference room **215**, in accordance with an embodiment of the invention. In this example, a conference is being held around a table **310** located in conference room **215**. Surrogate head device **100** is placed selectively on table **310**. A second surrogate head device **102** is also placed selectively on table **310**. Two individuals **322** and **324** are attending the conference in person, and two other individuals are participating

remotely via surrogate head devices **100** and **102**. By selective placement on table **310**, surrogate head devices **100** and **102** enable their respective operators to control their devices to achieve and maintain eye-to-eye contact with persons **322** and **324**, as desired. In addition, appropriate placement may also enable the operators of surrogate head devices **100** and **102** to maintain eye-to-eye contact with one another. Surrogate head devices **100** and **102** may also enable their respective operators to perceive audio signals, including voices, from the conference room, in a manner that simulates the sensation of being physically present in the conference room.

[0028] While the exemplary embodiment discussed herein describes a meeting held in a conference room, the systems, apparatus and methods described herein may be used to enable an individual to attend other types of meetings held in other places, from a remote location.

[0029] FIG. **4** is a block diagram of components of surrogate head device **100**, in accordance with the embodiment of FIG. **1**. Some of the components shown in FIG. **4** correspond to components shown in FIG. **1**. For example, surrogate head device **100** comprises display device **110**, audio speakers **120**-A and **120**-B, microphones **140**-A and **140**-B, camera **130**, pan base **155**, and tilt base **150**.

[0030] Surrogate head device **100** also comprises a processor **462**, an interface **464**, and a memory **466**. Processor **462** controls various operations of surrogate head device **100** by executing computer program instructions which define such operations. The computer program instructions may be stored in a non-transitory computer readable medium such as a random access memory (RAM), one or more disk drives, one or more optical disks, one or more tape drives, etc. Processor **462** may comprise hardware, software, or a combination of hardware and software. For example, in one embodiment, processor **462** comprises operating system software controlled by hardware, such as a central processing unit (CPU).

[0031] Interface **464** provides a communication gateway through which data may be transmitted between components of surrogate head device **100** and network **205**. For example, interface **464** transmits to remote control device **230**, via network **205**, audio signals received by microphones **140**-A and **140**-B and video signals received by camera **130**. Interface **464** receives audio signals and video signals from remote control device **230**, via network **205**, and transmits the audio and video signals to speakers **120**-A and **120**-B, and to display device **110**, respectively. Interface **464** also receives control signals received from remote control device **230**, and transmits the control signals to control module **457**. In various embodiments, interface **464** may be implemented using a number of different mechanisms, such as one or more enterprise systems connection cards, modems, or network interfaces. Other types of interfaces may be used.

[0032] Memory **466** is accessed by processor **462** and/or other components of surrogate head device **100** to store various types of information. Memory **466** may comprise any one or more of a variety of different types of non-transitory computer readable media, such as random access memory (RAM), one or more disk drives, one or more optical disks, one or more tape drives, etc. Other types of memory devices may be used.

[0033] In one embodiment, pan base **155** may comprise one or more electromechanical components such as servos, motors, control circuitry, gears, etc., configured to enable pan base **155** to move in response to control signals. Pan base **155** may also comprise one or more microprocessors and memory devices to facilitate its operation. In other embodiments, other mechanisms may be used to control the movements of pan base **155**.

[0034] In one embodiment, tilt base **150** may comprise one or more electromechanical components such as servos, motors, control circuitry, gears, etc., configured to enable tilt base **150** to move in response to control signals. Tilt base **150** may also comprise one or more microprocessors and memory devices to facilitate its operation. In other embodiments, other mechanisms may be used to control the movements of tilt base **150**.

[0035] Surrogate head device **100** also comprises a control module **457**. Control module **457** receives control signals from remote control device **230** (shown in FIG. **2**), and controls the movement of pan base **155** and tilt base **150** in response to the control signals. For example, control module **457** may generate electrical signals and transmit such signals to servos and/or other components within pan base **155** and tilt base **150** in response to control signals received from remote control device **230**. Control module **457** may also control functions of camera **130**, display device **110**, audio speakers **120**-A and **120**-B, and microphones **140**-A and **140**-B based on control signals received from remote control device **230**.

[0036] Control module **457** may comprise a software program that includes multiple modules or subroutines providing respective services or functions, for example. In other embodiments, control module **457** may comprise multiple software programs. In alternative embodiments, control module **457** may comprise hardware, or a combination of hardware and software. Control module **457** may comprise a non-transitory computer readable medium, such as a magnetic disk, magnetic tape, or optical disk, that includes instructions in the form of computer code operable to perform various functions. In some embodiments, some or all of control module **457** may comprise instructions in the form of computer code that are stored in memory **466**.

[0037] In other embodiments, surrogate head device **100** may comprise other components (software or hardware) in addition to those discussed herein.

[0038] FIG. **5** shows a remote participant **585** employing a remote control device **230** to control a surrogate head device, in accordance with an embodiment of the invention. In this example, remote control device **230** comprises a personal computer. Remote control device **230** comprises a display screen **568**, a camera **562**, a keyboard **574**, and a mouse device **576**. Remote control device **230** also comprises speakers **566** and microphone **564**. In this example, speakers **566** include two speakers in a set of headphones worn by remote participant **585**. Alternatively, remote control device **230** may comprise another type of device capable of two-way communication with a surrogate head device, such as a laptop computer, a handheld computer, a cell phone, a laptop, a Blackberry, etc.

[0039] Referring again to FIG. **2**, remote control device **230** is linked to surrogate head device **100** via network **205**, enabling remote participant **585** to control surrogate head device **100** remotely. Remote participant **585** may use mouse device **576** and/or keyboard **574** to generate control signals for controlling the movement of surrogate head device **100**. Mouse device **576** may be a computer mouse with two buttons and a scroll wheel, for example. Keyboard **574** may be a QWERTY keyboard. Other types of mouse devices and key-

boards may be used, or other types of devices capable of generating control signals, such as a joystick, a touchpad, etc.

[0040] Display device **568** may comprise a liquid crystal display ("LCD"). In other embodiments, display device **568** may comprise another type of display device. Audio speakers **566** may comprise any type of audio device capable of reproducing voice signals and other audio signals that may be received from surrogate head device **100**. Camera **562** may comprise any type of camera capable of capturing images and generating corresponding video data for transmission to surrogate head device **100**. Microphone **564** may comprise any type of device capable of detecting sounds and generating corresponding audio data for transmission to surrogate head device **100**.

[0041] FIG. **6** is a block diagram of components of remote control device **230**, in accordance with an embodiment of the invention. Some of the components of remote control device **230** shown in FIG. **6** correspond to components shown in FIG. **5**. For example, remote control device **230** comprises display device **568**, microphone **564**, camera **562**, mouse device **576**, and keyboard **574**. In this embodiment, speakers **566** comprise two speakers, including a right speaker **566**-A and a left speaker **566**-B, in a set of headphones.

[0042] Remote control device **230** also comprises a processor **610**, an interface **620**, and a memory **630**. Processor **610** controls various operations of remote control device **230** by executing computer program instructions which define such operations. The computer program instructions may be stored in a non-transitory computer readable medium such as a random access memory (RAM), one or more disk drives, one or more optical disks, one or more tape drives, etc. Processor **610** may comprise hardware, software, or a combination of hardware and software. For example, in one embodiment, processor **610** comprises operating system software controlled by hardware, such as a central processing unit (CPU).

[0043] Interface **620** provides a communication gateway through which data may be transmitted between components of remote control device **230** and network **205**. Interface **620** transmits to surrogate head device **100**, via network **205**, audio signals received by microphone **564** and video signals received by camera **562**. Interface **620** receives audio signals and video signals from surrogate head device **100**, via network **205**, and transmits such signals to speakers **566** and to display device **568**, respectively. Interface **620** receives control signals from remote control module **640** and transmits the control signals to surrogate head device **100**. In some embodiments, interface **620** may receive control signals directly from mouse device **576** and from keyboard **574**, and transmit the control signals to surrogate head device **100**. In various embodiments, interface **620** may be implemented using a number of different mechanisms, such as one or more enterprise systems connection cards, modems, or network interfaces. Other types of interfaces may be used.

[0044] Memory **630** is accessed by processor **610** and/or other components of remote control device **230** to store various types of information. Memory **630** may comprise any one or more of a variety of different types of non-transitory computer readable media, such as random access memory (RAM), one or more disk drives, one or more optical disks, one or more tape drives, etc. Other types of memory devices may be used.

[0045] Remote control device **230** also comprises a remote control module **640**. Remote control module **640** receives signals from mouse device **576** and from keyboard **574**, and converts such signals into corresponding control signals for controlling surrogate head device **100**. For example, movements of mouse device **576**, or selections of keys on keyboard **574**, may be detected and converted into appropriate control signals for controlling the movement of surrogate head device **100**. Remote control module **640** transmits such control signals to surrogate head device **100** via interface **620**. In another embodiment, a speech recognition system may be used to detect voice commands spoken by the remote participant, and generate corresponding control signals. In other embodiments, a gesture control system, and/or a facial recognition system may be used to detect facial movements and/or gestures made by the remote participant, and generate corresponding control signals.

[0046] Remote control module **640** may comprise a software program that includes multiple modules or subroutines providing respective services or functions, for example. In other embodiments, remote control module **640** may comprise multiple software programs. In alternative embodiments, remote control module **640** may comprise hardware, or a combination of hardware and software. Remote control module **640** may comprise a non-transitory computer readable medium, such as a magnetic disk, magnetic tape, or optical disk, that includes instructions in the form of computer code operable to perform various functions. In some embodiments, some or all of remote control module **640** may comprise instructions in the form of computer code that are stored in memory **630**.

[0047] In other embodiments, remote control device **230** may comprise other components (software or hardware) in addition to those discussed herein.

[0048] In one embodiment, sounds detected by microphones **140**-A and **140**-B on surrogate head device **100** are selectively mapped to speakers **566**-A and **566**-B of remote control device **230**, generating for remote participant **585** a simulation of being present in conference room **215**. For example, when an individual seated in conference room **215** to the right of surrogate head device **100** speaks, the sounds detected by microphone **140**-A are mapped to the remote participant's headphone speaker **566**-A, and the sounds detected by microphone **140**-B are mapped to the remote participant's headphone speaker **566**-B, causing the remote participant to perceive a voice coming from his or her right side. In the exemplary embodiment, control module **457** (shown in FIG. **4**) of surrogate head device **100** may perform processing to map the respective audio signals detected by microphones **140**-A and **140**-B to two "stereo" transmission channels associated with speakers **566**-A and **566**-B, respectively, prior to transmitting the signals to remote control device **230**. For example, a first transmission channel A corresponding to "right" and a second transmission channel B corresponding to "left" may be used. The audio signals are received at remote control device **230** via the two transmission channels, and transmitted respectively to the corresponding speakers **566**-A and **566**-B. In other embodiments, the respective audio signals detected by microphones **140**-A and **140**-B may be mapped respectively to speakers **566**-A and **566**-B using other techniques, such as by using other types of channels, by coding, etc. In another embodiment, signals detected by microphones **140**-A and **140**-B are transmitted by surrogate head device **100** directly to remote control device **230**, and remote control module **640** maps the audio signals to speakers **566**-A and **556**-B.

[0049] In some embodiments, including the embodiment described above, a remote participant operating remote control device **230** controls surrogate head device **100** to achieve and maintain eye contact with an individual in conference room **215**. For example, appropriate rotation of surrogate head device **100** by a remote participant toward an individual who is speaking in conference room **215** may enable the remote operator and the speaker to see each other's faces and expressions in real-time, enabling eye-to eye contact to be achieved and maintained.

[0050] FIG. **7** is a flowchart depicting a method for conducting two-way audio and video communications, in accordance with an embodiment of the invention. At step **710**, first video data is transmitted from a first location to a second location, and second video data received from the second location is displayed at the first location. In the exemplary embodiment, surrogate head device **100** transmits video data from conference room **215** to remote control device **230**, and displays video data received from remote control device **230** to participants in conference room **215**.

[0051] At step **720**, two respective audio signals are detected at two microphones located on the device at the first location. As discussed above, surrogate head device **100** detects two audio signals at microphones **140**-A and **140**-B. The audio signals may contain voice signals, for example. At step **730**, the two audio signals are mapped respectively to two channels associated with two speakers used by an operator at the second location. In the exemplary embodiment, surrogate head device **100** maps the two audio signals to two transmission channels (channels A and B, discussed above) and transmits the signals to remote control device **230**. The two transmission channels are associated with two speakers in the remote operator's headphones **566**.

[0052] At step **740**, at least a portion of the device moves about at least one axis in response to control signals received from the operator at the second location. As discussed above, surrogate head device **100** receives control signals from remote control device **230**, and in response, head portion **172** is rotated around a vertical axis by pan base **155** and/or about a horizontal axis by tilt base **150**.

[0053] In some embodiments, the method steps described in FIG. **7** are defined by computer program instructions that are stored in memory **466** of surrogate head device **100** and executed by processor **462**. In one example, control module **457** comprises computer program instructions implemented as computer executable code appropriately programmed by one skilled in the art to perform the algorithm defined by the method steps described in FIG. **7**. By executing the computer program instructions, processor **462** executes the algorithm defined by the method steps of FIG. **7**.

[0054] The foregoing Detailed Description is to be understood as being in every respect illustrative and exemplary, but not restrictive, and the scope of the invention disclosed herein is not to be determined from the Detailed Description, but rather from the claims as interpreted according to the full breadth permitted by the patent laws. It is to be understood that the embodiments shown and described herein are only illustrative of the principles of the present invention and that various modifications may be implemented by those skilled in the art without departing from the scope and spirit of the invention. Those skilled in the art could implement various other feature combinations without departing from the scope and spirit of the invention.

1. A communication device comprising:
- a two-way video system for transmitting first video data from a first location to a second location, and displaying at the first location second video data received from the second location;
- two microphones for generating two respective audio signals; and
- at least one processor configured to:
  - map the two audio signals respectively to two speakers used by an operator at the second location; and
  - move at least a portion of the device about at least one axis in response to control signals received from the second location.

2. The communication device of claim **1**, wherein the two-way video system comprises at least one display device.

3. The communication device of claim **1**, further comprising at least one base portion configured to rotate about the at least one axis in response to the control signals.

4. The communication device of claim **3**, wherein the at least one base portion comprises a first portion configured to rotate about a substantially vertical axis and a second portion configured to rotate about a substantially horizontal axis.

5. The communication device of claim **1**, wherein the two microphones are disposed in a manner to approximate a perception of sounds by a human.

6. The communication device of claim **1**, wherein the at least one processor is further configured to:
- map a first one of the two audio signals to a first transmission channel associated with a right side; and
- map a second one of the two audio signals to a second transmission channel associated with a left side.

7. The communication device of claim **6**, wherein the first and second transmission channels are associated respectively with first and second speakers in headphones used by the operator at the second location.

8. The communication device of claim **1**, wherein the control signals are received from the second location via a network.

9. A method for controlling a device disposed at a first location, the method comprising:
- transmitting first video data from a first location to a second location;
- displaying at the first location second video data received from the second location;
- detecting two respective audio signals;
- mapping the two audio signals respectively to two speakers used by an operator at a second location; and
- moving at least a portion of the device about at least one axis in response to control signals received from the second location.

10. The method of claim **9**, wherein the step of moving at least a portion of the device about at least one axis in response to control signals received from the second location further comprises:
- rotating at least a first portion of the device about a substantially vertical axis; and
- rotating at least a second portion of the device about a substantially horizontal axis.

11. The method of claim **9**, wherein the step of mapping the two audio signals respectively to two speakers used by an operator at a second location further comprises:

mapping a first one of the two audio signals to a first transmission channel associated with a right side; and

mapping a second one of the two audio signals to a second transmission channel associated with a left side.

12. The method claim **11**, wherein the first and second transmission channels are associated respectively with first and second speakers in headphones used by the operator at the second location.

13. The method of claim **9**, further comprising:

receiving the control signals from the second location via a network.

14. A computer readable medium having program instructions stored thereon, the instructions capable of execution by a processor and defining the steps of:

transmitting first video data from a first location to a second location;

displaying at the first location second video data received from the second location;

detecting two respective audio signals;

mapping the two audio signals respectively to two speakers used by an operator at a second location; and

moving at least a portion of the device about at least one axis in response to control signals received from the second location.

15. The computer readable medium of claim **14**, wherein the program instructions defining the step of moving at least a portion of the device about at least one axis in response to control signals received from the second location further comprises program instructions defining the steps of:

rotating at least a first portion of the device about a substantially vertical axis; and

rotating at least a second portion of the device about a substantially horizontal axis.

16. The computer readable medium of claim **14**, wherein the program instructions defining the step of mapping the two audio signals respectively to two speakers used by an operator at a second location further comprises program instructions defining the steps of:

mapping a first one of the two audio signals to a first transmission channel associated with a right side; and

mapping a second one of the two audio signals to a second transmission channel associated with a left side.

17. The computer readable medium of claim **16**, wherein the first and second transmission channels are associated respectively with first and second speakers in headphones used by the operator at the second location.

18. The computer readable medium of claim **14**, wherein the program instructions further comprise program instructions defining the step of:

receiving the control signals from the second location via a network.

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